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Original Paper

Market Performance of Sponsor-Backed Initial Public Offerings: An Empirical Analysis of the German Market

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Abstract

This paper investigates the overall market performance of Initial Public Offerings (IPOs) in Germany, by analyzing the short and long run performance of IPOs, utilizing the data from 2000-2013. Furthermore the study aims to distinguish and compare the performance of sponsor backed IPOs to non-sponsor backed IPOs, by placing a special focus on the value creating abilities of financial sponsors. The examined data set consists of 286 IPOs out of which 46 can be considered as IPOs which were backed by financial sponsor. The study suggests that, on average, IPOs significantly underperform their benchmarks. Furthermore, the evidence implies significant differences across the IPO groups with regard to performance and operational indicators. The multivariate regression shows that in the long run, private equity firms outperform their counterparts, signified by greater buy-and hold abnormal returns respectively recorded within the three-year period after the IPO.

Keywords

Initial Public Offerings, financial sponsors, private equity, venture capital, MSCI, SDAX, MDAX, DAX 30, FISE

1. Introduction

1.1 Background Information

The origin of private equity and venture capital traces back to the 1940s when first structures of private equity financing got established, characterized however by rather small volumes and limited appliances. Nevertheless, it took roughly about 40 years (1980s) when the advent of the leveraged buyout boom in the United States initiated the first private equity wave (Nyman, 2002). In Europe conversely, this form of corporate financing, often regarded as financial sponsoring, gained momentum at a later stage (1990s), strongly related to the regulative liberalization of the financial markets for institutional

investors.

Triggered by the financial crisis, the role of financial sponsoring (Note 1) has gained particular importance within the recent years. Governments around the world responded to the bust period by prompting the tightening of laws on capital requirements (e.g., Basel III). This fundamental regulative implementation had significant consequences, especially on traditional lending institutions such as banks. This new market environment led to a financing gap that has not only been filled by financial sponsoring in the recent years, but is also expected to be increasingly filled by it in the future (Federal Ministry of Finance, 2013).

The described rapid developments of corporate financing by the use of private equity is clearly visible by Figure 1, which depicts the global deal value and number of global buyout-backed exits according to their exit channel, from the years 2000-2016. The graph not only illustrates the strong relationship between private equity deal volumes and the business cycle but also shows that within twelve years (2002-2014), exit value of buyouts nearly ten folded from $44bn (2002) to about $458bn (2014) at its peak.

Furthermore the graph depicts, that trade sales, in which a financial sponsor sells the company to a strategic buyer (e.g., company which is operating in the same industry as the target), represent the most common exit route for financial sponsors. Secondary buyouts (Note 2) and initial public offerings (Note 3) (IPOs) represent, quite equally, other important possible routes a financial sponsor may choose in order to exit their investment.

Private equity can be defined as an ownership model, which commonly invests in unlisted companies, thereby playing a vital role in growing companies across various industries and countries (EQT, 2017). The private equity firms acquire companies on which they apply value creation and enhancement measures during their investment phase in order to benefit at the divestment from the increases in firms value, thereby generating excessive returns (Achleitner, Figge, & Lutz, 2014).

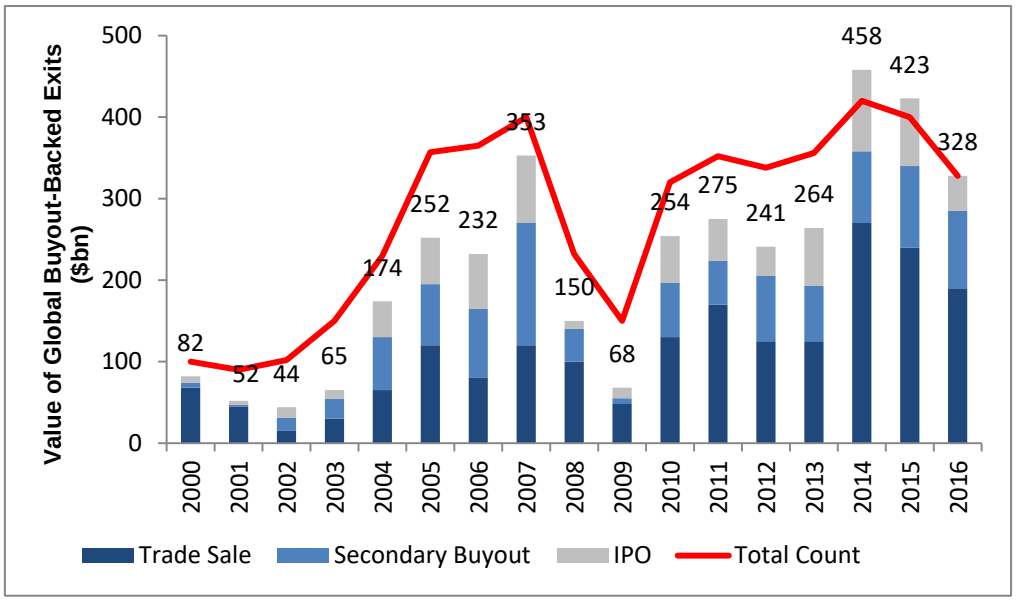

Figure 1. Global Buyout-Backed Deal Volume by Exit Channel and Number of Buyout-Backed Exits (2000-2016)

Source: Bain & Company (2017).

According to existing literature, the value creation, expressed in improved company performance is predominantly driven by operational improvements such as an improved capital structure, higher management expertise and closer monitoring capabilities. However, the stated operational improvements are often synonymic to great lay-offs and the downsizing of human capital—therefore critics argue that private equity firms rather destruct value than create it (Johansson, 2011). Furthermore critics claim that the rather limited investment horizon (3-7 years) leads to short-term value maximization in order to exit at the possible highest value, often not in alignment with the firms' best interests.

Therefore strong disagreements among researchers existed concerning the question whether portfolio firms would be actually better off without private equity ownership, especially with regard to their long run performance. Hence, especially in the US, research has been established that aimed to analyse the ability of financial sponsors to create value for firms. Due to the fact that data access for publicly traded stocks is superior compared to other exit channels of financial sponsors, initial public offerings were the focus of investigation by academics. Research regarding financial sponsorship of IPOs has identified multiple phenomena such as short-term under-pricing and long-run underperformance for instance.

When examining the performance differences between sponsor-backed and non-backed IPOs, the evidence within different markets is quite controversial: whereas studies in North America conclude in general a superior performance of sponsor-backed IPOs compared to their counterparts, the evidence in Europe is rather divided (Lammi, 2016). Levis (2011) for instance investigated the IPO performances

on the London Stock Exchange and identified a fragmented market: whereas private-equity backed IPOs outperform non-backed samples at the same time, venture-capital backed IPOs actually underperform the respective samples. Hence, the market performances and related reasons are yet not sufficiently examined on the European market.

The paper is divided into six parts: literature review, hypotheses, methodology, result presentation, discussion of results, and conclusion. The last two parts of the thesis will present the empirical findings of the study and will consecutively discuss and link the distinctive study results to the findings of previously conducted research that will be mentioned in the literature review. A conclusion will also indicate the limitations of the identified patterns and results.

2. Literature Review

2.1 Private Equity—Structure of a Private Equity Fund

Private equity can be defined as the provision of equity capital by financial investors to a private or public company via a buyout, which leads to a delisting of the respective entity (public to private). Private equity firms raise capital through private equity funds, which are in most cases closed-end funds, with a typical life span of ten to twelve years, in which capital commitment by investors cannot be withdrawn until the fund is terminated (Stein, 2005).

Most of the fund's capital is derived from its Limited Partners (LPs), which typically include institutional investors such as public and private pension funds, insurance companies and university endowments or originate from high net worth individuals (Kaplan & Strömberg, 2008). The private equity firm appears as the General Partner (GP) of the fund, in form of its partners, who also inject an equity portion into the fund and are responsible for its management (Figure 2).

2.2 Private Equity—Concept of a Private Equity Transaction

The subsequent steps, involved in a private equity transaction process are illustrated in Figure 2.

Figure 2. Process of a Private Equity Transaction

Source: Moelis & Company (2017).

The first stage of a typical private equity process can be considered as the *fundraising phase*, which approximately lasts for about six months. After a private equity firm determined its fund strategy, which classically contains levers such as the intended fund volume, characteristics of the investment target (e.g., industry, products, situation) and the intended return, the firm advertises its intended fund to prospective investors that will become the future limited partners of the fund in case of a subscription (Arundale, 2010).

As soon as the fund closes, its *investment phase* is inducted, which lasts for about five years, considering a classical fund lifetime of about ten years. During this essential time frame, the private equity company invests the capital of the fund into various (Note 4) companies that comply with its investment strategy. The takeover (majority stake acquisition or full ownership) of the respective investment targets is typically financed by a huge proportion of debt, usually 60-90%, and is considered as a Leveraged Buyout (LBO). Whereas the smaller equity portion is derived from the fund, debt investors, such as banks, finance the debt portion.

The last phase of a private equity transaction is the *exit phase*, which basically determines the success of all the previous phases and the entire private equity process. Due to the fact that private equity investors require a high return on their equity (usually targeting an IRR (Note 5) between 20-30%), the exit opportunities of the potential investment are already evaluated during the investment phase by the assumption of future exit valuation. The most common three exit routes for private equity firms, which have already been mentioned briefly, are the sale to a strategic buyer (trade sale), a financial buyer (secondary buyout) or the exit via an IPO.

In a trade sale, the private equity firm sells all its complete shares to a strategic buyer, which is usually a company that operates in the same industry as the target company. As the strategic buyer is often able to realize synergies through the purchase, the exit valuation and the related sale are often priced the highest among the three exit options (HVCA, 2016).

In a secondary buyout, the held portfolio company is sold to another private equity firm. The reason for the acquisition interest in the target is that the buy-side private equity firm still sees upside potential for eventual improvements or other value enhancement measures. In both stated exit routes, the ownership of the private equity firm is typically fully liquidated.

The exit route via an Initial Public Offering (IPO), which represents the focus of the analysis and will be discussed in detail within the next section, takes the company public (Note 6). The private equity firm hereby liquidates its shares by selling them on the stock market. Lock-up periods, which prohibit the sale of the entire shares immediately after going public, together with other regulative guidelines and strategic considerations, ensure that the private equity firm still maintains a significant share of the target after the exit (Levis, 2008). This limited flexibility together with the fact that IPOs are time consuming and involve huge transaction costs are among others reasons why trade sales or secondary buyouts are typically more preferred exit routes than an IPO.

2.3 Venture Capital

Venture capital financing has rapidly grown within the last two decades due to the fact that it represents the specifically targeted financing instrument enabling to close the funding gap for young entrepreneurial firms.

Venture capital investments can be defined as “professionally managed and independent pools of capital, which focus on the dedicated provision of equity- or equity-linked investments in privately held, high growth companies” (Gompers & Lerner, 2001). The equity component of venture capitalists is in

most cases accumulated within a VC-fund and derives from several sources such as wealthy and high net worth individuals, institutions or companies that possess a venture capital arm.

The involved risk, in any of the described venture capital investment types, is generally higher compared to private equity investments due to higher volatility of the success of young start-up firms. Consequently, expected returns are higher than in private equity investments, approximately amounting to 20%.

After the acquisition of respective promising, high-growth entities, the venture capitalists often take a very active role in the start-up firms (managing phase), not only supporting the management in strategic decisions, but even actively deciding which future positioning and strategy the underlying portfolio company will pursue. Therefore VCs aim to add value to portfolio firms by close monitoring, managerial- and strategic advice, aiming to accelerate the growth trajectory of their selected entrepreneurial companies.

The average holding period of an investment into a start-up company by a venture capitalist ranges from about five to ten years. The returns for VC-investors are generally capitalized when the venture capital firms exits its investment entity (Spierings, 2011). The two prevalent exit routes of venture capitalists are either a trade sale or an IPO. In a trade sale, a larger company acquirers the underlying portfolio company of the VC either by cash or shares. Usually, only the most successful companies are being taken public via an IPO. Due to lock-up agreements the VCs are however unable, and often also unwilling (e.g., exit acts as a negative signal) to directly exit the company just after the IPO (Berger & Udell, 1998). The VC investments however, that pursued an IPO as its exit route, will represent the focus within the underlying study.

However, it can be generally said that the time it takes to develop a venture usually exceeds the typical investment horizon of a venture capital firm, so that venture capitalists usually specialize in certain investment types and stages, leading to high variations in the risk-return relationship amongst VCs.

2.4 IPOs—Performance Investigation

The performance analysis of initial public offerings is basis to a huge amount of research that has been conducted so far since the 1960s. Two dominant phenomena have been observed empirically that are extensively discussed in literature: short-run under-pricing and long-run underperformance. The following section will list and discuss important theories that are related to these two phenomena.

2.4.1 Short Run Performance of IPOs

The most commonly observed performance phenomena, considering the time frame immediately after an IPO, is called under-pricing, in which an IPO is priced below its market value. This is the fact, when the offer price of the stock is below its closing price on the first trading date. This under-pricing shows high variations in distinctive markets as well as in the magnitude, but can be broadly estimated to be in the range of 10-20% on average. This under-pricing implies that the potential maximum amount of equity that could have been raised by firms in an IPO is, on average, significantly subdued (Ibbotson, 1975).

The key parties involved in an IPO transaction are the issuing firm (Note 7), the underwriter, which is usually an investment bank that is marketing and underwriting the deal and investors (Ljungqvist, 2004). Most of the well established theories and models that explain under-pricing are based on asymmetric information, assuming that one of these parties has superior information over the others.

a) Under-Pricing—Based on Asymmetric Information

The "winners curse" theory relies on the adverse selection problem, which assumes that there are two types of investors with different information about the fair value of the shares: uninformed and well-informed investors. Whereas the uninformed investors also bid for overpriced shares on the capital market, well-informed investors merely bid for under-priced IPOs. Therefore under-pricing is not only a tool to keep uniformed investors in the market by compensating for their losses, but also increases the attractiveness of the respective shares for informed investors (Rock, 1986).

The theory established by Baron (1982) is based on a principal agent problem, which assumes that the underwriter has a better informational access to demand conditions on the market than the issuing firm. Therefore the underwriter uses under-pricing in order to encourage the maximum selling efforts, which obviously creates agency costs (Bessler & Thies, 2008).

Another theory however, which is based on the signalling effect, reveals that the issuing firms have superior information over the firms intrinsic value so that they are able to use the under-pricing mechanism to signal their worthiness. Therefore valuable and well-performing firms can reduce the information asymmetry for investors by signalling their true value via under-pricing (Welch, 1989).

Benveniste and Spindt (1989) established a further theory that argues that well-informed investors, which truthfully disclose their estimation of the intrinsic stock value, when the IPO is marketed, are compensated by under-pricing as they help underwriters to reduce the potential pricing inefficiencies (Ljungqvist, 2004).

b) Under-Pricing—Based on Firm-Specific Characteristics

With regard to firm-specific characteristics, research assumes that company size and under-pricing are inversely related. This originates from the fact that larger companies have a higher reputation on capital markets that demand a lower under-pricing magnitude compared to smaller companies (Ritter, 1984).

Furthermore Clarkson and Merkley (1994) identified that the offering size of an IPO is also inversely related to the magnitude of under-pricing. Investors apply higher speculative efforts among smaller offer sizes, implying a greater risk for them, in turn, leading to a greater compensation need by stock under-pricing (Lammi, 2016).

c) Under-Pricing—Based on Market-Specific Characteristics

Considering the empirical evidence that the markets provide us with, it can be said that the magnitude of under-pricing is related to variations in the business cycle (Loughran & Ritter, 2004). While average under-pricing reached its peak during the internet bubble in 1997-2000, with under-pricing levels of approximately 65%, it has declined to moderate levels quite after the bubble period (12% on average). This phenomenon can partly be explained by the fact that issuing firms explicitly sought after

underwriting companies with a significant underwriting reputation. High-level management of the issuing companies consequently traded a part of the under-priced shares internally in personalized accounts (Lammi, 2016).

2.5 Long Run Performance of IPOs

In addition to the studied short-run performance based on the phenomenon of under-pricing, extensive research has also been conducted with regard to the long-run performance of IPOs.

According to Ritter (1991), who has studied the long-run performance of IPOs in the US, IPOs significantly underperform (Note 8) an appropriate benchmark (e.g., S&P 500) over a studied three-year period. The IPO performance was exceptionally poor during bull market conditions, in which IPO volumes were significantly high and equity valuations were at its peak. This hypothesis is in close alignment with the "windows of opportunity" within the market-timing theories, in which companies seem to exploit the high equity valuation levels of investors on the capital market.

Other studies by Schultz (2003) or Brav and Gompers (1997), however reveal that the underperformance is actually caused by calculations without value-weighted matching. Therefore they identified, when matching respective benchmarks with underlying book-to-market ratios and size of the observed companies, by value-weighting the IPO returns, underperformance is significantly diminished (Lammi, 2016).

Despite the challenging research findings and hypotheses of Brav and Gompers (1997) and Lerner (2003), the predominant view through the identified pattern is, that in the long run, IPOs underperform. One reason might be that investors are too optimistic about the long-run performance of firms and adjust their actions over time by being more realistic (Bessler & Thies, 2008). Another possibility is that the pricing of IPOs is fair in the primary market but overpriced instead from the first trading day on the secondary market. According to this hypothesis, by using the offer price as the starting point, IPOs are correctly valued in the long run but overpriced instead in the secondary market. Therefore the whole theory of short-run under-pricing would be twisted towards a short-term overpricing phenomenon (Bessler & Thies, 2008).

Conclusively it can be suggested that information asymmetries as well as agency problems, which have been examined in the short run, also exist in the long run and thus embody a prevailing factor to explain the underperformance of IPOs in the long run.

2.6 Performance of Sponsor-Backed IPOs

2.6.1 Short-Run Performance of Sponsor-Backed IPOs

When sponsor-backed (Note 9) companies decide to go public, the involvement of a sponsor within the issuing firm should be seen as a positive sign that provides the firm with a reliable certification of quality when going public (Bessler & Seim, 2012). Consequently, this may results in a decreased magnitude of under-pricing for sponsor-backed IPOs compared to their non-backed counterparts (Megginson & Weiss, 1991).

Contrary to the stated hypothesis, the study conducted by Francis and Hasan (2001) did not identify

any under-pricing differences between sponsor-backed and non-backed IPOs. The researcher Wahal and Lee (2004) even argue that although VCs exit from their portfolio firms in rather favourable market conditions, they do not time their exit optimally, as their willingness of liquidating ownership outweighs maximization of their equity stake.

Apart from the fact that the majority of literature ascertains that sponsor-backed IPOs show a lower under-pricing magnitude, it should be noted that most of the research that has been conducted is based on the US market, justifying the underlying investigation of the German IPO market, as a logical next step in order to enrich the research field within the European market.

2.6.2 Long Run Performance of Sponsor-Backed IPOs

One of the most famous studies that compare the long run performances of sponsor-backed and non-sponsor backed IPOs were established by Brav and Gompers (1997). The results of the research of the US market imply that sponsor backed IPOs perform superior to their non-sponsored counterparts, considering equal weighted returns (Note 10). They argue that the reason for the outperformance originates from the managerial competencies of private equity firms such as a close monitoring, an optimized capital structure and efficient operational performance. Furthermore they identified that as soon as the private equity or venture capital firm exits the company, the magnitude of underperformance directly rises. This again illustrates that the sponsors possess extensive insights into the company and its respective valuation, exiting the company when stock prices are deemed to be overvalued (Bessler & Kurth, 2003).

Another theory suggests that renowned private equity firms diligently select and filter their portfolio companies according to strict quality criteria in the first place (Krishnan et al., 2009). Consequently private equity backed IPOs in the US show higher performance levels than their non-backed counterparts.

Considering the European research landscape, Frederikslust and van der Geest (2001) have identified that on the Amsterdam Stock Exchange, private equity backed IPOs did not necessarily underperform the set benchmarks in the long-run, whereas non-backed IPOs showed significant levels of underperformance. They trace this performance difference back to the fact that private equity firms acquire their portfolio companies only if their target returns are reached. As these returns are based on superior company performance during the holding period, investors judge it as a quality signal that leads to a high demand of the stock on the capital markets (Lammi, 2016).

Another comprehensive and recent study over the European market performance of private equity backed IPOs has been established by Levis (2009). It identified that on the London Stock Exchange, IPOs with private equity background show superior long run aftermarket- and operating performances. He signifies that the degrees of ownership by financial sponsors as well as the leverage level are two levers that are closely and positively correlated to the performance of the stock (Levis, 2011).

Despite the two mentioned research results, which imply a superior performance of IPOs backed by a financial sponsor, the European market can be considered as fragmented, due to a relatively high

degree of controversy about the performance levels of the respective IPO-forms and high variations among national equity market conditions

2.7 The German Equity Market—Setting for IPOs and Private Equity

The characteristics and regulation of the German Stock Exchange set an important framework for firms going public. The legal-, banking- and corporate governance system and structure are quite distinctive to that of the United States, assuming also differences in the performance results of IPOs (Bessler & Kurth, 2003). Whereas in the US, IPOs of growth- and high-tech firms were a regular phenomenon, companies that went public in Germany, used to be rather mature and well-established companies, in the past (Bessler & Thies, 2008).

A further important characteristic to consider is the existence of a lock-up period of at least six months after going public, in which investors or shareholders are not allowed to sell shares. This period is not only limiting the flexibility of financial sponsors, but also makes the time window around the expiration date of the lock-up period of specific interest, especially with regard to the actions by the private equity firms. A possible exit or an extension of the holding period may indicate a signal for outside investors about the attractiveness of the stock.

Not only by considering the diverging regulative frameworks for IPOs, but also by looking at the significant volume differences of buyout-backed exits of private equity investors (US: $182bn; Europe: $107bn), it can be said that results may be deviating from research based on the IPO market of the United States.

3. Hypotheses

The previously discussed literature regarding the performance of IPOs suggests that especially in Europe, research results show huge variations in IPO performances. As a clear performance pattern can consequently not be identified, the aim of the paper is to close this research gap to a certain degree. As Germany can be identified as one of the most important and biggest IPO markets in the European research sphere, the performance of IPOs on the German market will be investigated in detail for the time span of the year 2000-2013.

3.1 Hypothesis 1: German IPOs Underperform Their Benchmarks (Note 11) in the Long Run

The extensively discussed literature advocates that IPOs, on average, used to underperform the equity markets and their non-issuing counterparts. It is argued that the favourable conditions for companies to go public (windows of opportunity) imply overvaluations on the equity markets, leading to a significant under-pricing for the first-trading day. It is suggested however, that equity markets absorb this under-pricing in the long run by mean-reverting performances, which hypothesizes that, in the long run, IPOs underperform the equity markets in Germany. How the expected negative abnormal returns are calculated, will be explained in the next section.

3.2 Hypothesis 2: German Sponsor-Backed IPOs Outperform Non Sponsor-Backed IPOs in the Long Run

The arguments for an over-performance of sponsor-backed IPOs compared to their non-backed counterparts have been raised by various researches, which have especially been conducted in the US market. It is argued that the strong managerial expertise paired with financial power and strategic excellence of private equity firms, enables superior performance, indicated by higher returns, compared to companies that go public without the backing of a financial sponsor.

The financial sponsors will be divided into subsamples consisting of private equity and venture capital in order to establish a higher degree of detail in the investigation. Due to the fact that venture capitalists invest into companies with a higher risk profile and a lower maturity, it is expected that they underperform the IPOs backed by private equity investors, ceteris paribus.

4. Data, Methodology & Variables

4.1 Data—Country Selection & Time Frame

The overall focus of the market performance analysis is the measurement of the long-run performance of sponsor-backed IPOs in comparison to their selected benchmark as well as to their non-backed counterparts. As already stated, this analysis will be conducted for the German IPO market, which has been selected as the focus country for the forthcoming performance analysis. It is assumed that Germany, despite the fragmentation of the European market, illustrates a representative sample for the European market, which is sufficiently extensive to draw reliable conclusions.

As long-run abnormal return analyses are conducted by looking at the performances including 36-months after the initial public offering, the last available data that can be used in order to properly analyse the long-run returns are derived from the year 2013. Therefore the time frame, from which IPO data has been selected for the analysis ranges from the year 2000-2013, thereby representing the latest available data set for IPOs in Germany.

Consequently, the data set used for the analysis, consists of 324 IPOs on the German market between the year 2000-2013, after the exclusion (Note 12) of re-listings, market transfers, property funds and investment trusts.

4.2 Data—Sources

The major sources for the IPO data (e.g., stock-prices), data for the index benchmarks as well as data that enable the classification of the type of sponsor an IPO is backed with (none, private equity or venture capital), were the *Thomson Reuters Datastream* and *Zephyr*.

The *Thomson Reuter Datastream* is a renowned and common source for financial data and enables the listing and filtering of the suitable IPOs (2000-2013) as well as the obtainment of all historical equity and trading data of all single traded companies. From the previously identified entire IPO dataset of 324 IPOs during 2000-2013, 286 IPOs have finally been investigated, due to a lack of sufficient stock price data for the remaining (38) respective companies.

Zephyr, which is a platform that offers comprehensive M&A data with integrated and detailed company information, has been used to define ownership of the IPOs. Accordingly, From the 286 identified IPOs, 46 IPOs have been identified as sponsor backed (PE = 21 companies; VC = 25 companies). Nevertheless it has to be mentioned that the establishment of a strict separation between venture capital- and private equity investments is often not clear because the respective firms partly operate in both investment markets.

4.3 Methodology—Calculation of Returns

The two most important aspects in identifying whether stocks outperform or underperform is on one hand to identify the appropriate method to calculate the abnormal returns, and on the other hand to compare the respective results to a suitable benchmark for the distinctive companies that went public (Bessler & Thies, 2008). Accordingly, empirical findings can frequently be explained by either of the two levers.

4.3.1 Calculation of Long Run Abnormal Returns

Whereas in early research papers, the Cumulative Abnormal Return method (CAR) used to be the prevailing technique to calculate abnormal returns, more recent papers increasingly make use of the Buy-and-Hold Abnormal Return method (BHAR). It is argued that the BHAR method is the most appropriate and accurate method to measure long-run performances as it depicts the experience of investors of holding stocks for an extended period (Conrad & Gautam, 1993).

BHAR are measured by compounding capital gains of a specific investment vehicle for a given period of time (Johansson, 2011). The way buy-and-hold abnormal returns are computed is demonstrated in the following formula:

$$BHAR = \frac{1}{N}\sum_{i=1}^{N}\left[\left(\prod_{t=1}^{T}(1+r_{it})\right)\right] - \left[\left(\prod_{t=1}^{T}(1+r_{bt}\right)\right]$$

In the BHAR equation, r_{it} is the raw return of an IPO-company (i) and r_{bt} represents the raw return of the benchmark (b) at month (t). N denotes the number of companies.

These BHARs will be investigated for the entire sample in order to identify the IPO performance against the benchmark as well as the performance differences between sponsor-backed IPOs and their non-sponsor backed counterparts.

4.3.2 Calculation of the Skewness-Adjusted T-Test

As the BHAR method is subject to a compounding effect, which may lead to positively skewed returns in the long-run, Johnson (1978) and Lyon (1999), adjusted the t-test towards a skewness-adjusted t-test. This adaptive model eradicates the bias, when using the BHAR-method and is calculated in the following way:

$$t_{sa} = \sqrt{n}\,(S + \frac{1}{3}yS^2 + \frac{1}{6n}y)$$

in which

$$S= \frac{\overline{AR_t}}{\sigma(AR_t)} \qquad \text{and} \qquad y= \frac{\sum_{i=1}^{n}(AR_{it}- \overline{AR_t})^3}{n\sigma(AR_t)^3}$$

AR_t and $\sigma(AR_t)$ represent the sample mean and the samples standard deviation of abnormal returns. Whereas N denotes the number of companies within the sample, y signifies an estimate of the skewness coefficient (Lyon et al, 1999).

4.3.3 Selection of Suitable Benchmarks

Apart from the selection of the appropriate method to measure abnormal returns (BHAR-method), the selection of suitable benchmarks is highly important as results change quite sensitively to the choice of respective benchmarks (Loughran & Ritter, 1995). In order to provide a very detailed analysis, exonerated from biases, various benchmarks are applied, with the aim of giving a comprehensive foundation of the right argumentation of the results.

The first benchmark that will be applied is the MSCI Germany index (Note 13), which is designed to measure the large and mid cap segments of the German IPO market, covering about 85% of the equity universe in Germany. This country-specific index aims to give an overall insight into the sample of identified IPOs.

The second benchmark that will be utilized adjusts the IPOs according to their size, with regard to market value on their offering date. In Germany the respective size adjusted benchmarks are the SDAX (small-cap), MDAX (mid-cap) and the DAX30 (large-cap). Any IPO of the sample will be categorized into one of the three indexes, according to their market value.

The third benchmark that will be applied classifies the IPOs according to their industry (FTSE industry classification (Note 14)), which in turn will be matched to their respective MSCI industry sector indexes.

4.4 Variables

The variables used in this section not only aim to define important characteristics of respective IPOs but also intend to analyse the performance differences across the sample. Apart form measuring abnormal returns via the BHAR method, a multiple regression will be run that uses dummy variables in order to compare the long-run IPO performances within the sample. In order to be able to analyse the data via a regression in section 5 (5.3), the initial dependent-, control- and dummy variables have to be defined. The selection is in close alignment of the quite recent studies of Levis (2009) and Lammi (2016).

4.4.1 First-Day Return (Initial Return)

The initial first day return represents a *control variable* for the forthcoming investigation and is calculated in the following way:

$$\text{First Day Return (Initial Return)} = \frac{\text{First Day Closing Price}}{\text{Offer Price}} - 1$$

As already discussed, it is assumed that IPOs that show a high level of under-pricing (high first day return), are expected to underperform in the long run, mirroring their mean-reverting characteristic. In

order to mitigate potential biases of very high and very low under-pricing levels, the natural logarithm for first day returns is used within the regression

4.4.2 Wealth Relative (Average Return)

In order to interpret the results of the stock returns, a Wealth Relative (WR) is used to evaluate the performance of respective stock against its benchmark. This WR is equally weighted over the 36-month period and represents the *dependent variable* of the regression analysis (Levis, 2009). As a benchmark the MSCI Germany index has been selected.

$$\text{Log Wealth Relative} = \ln\left(\frac{1+(\text{Average Return of IPO})}{1+(\text{Average Return of MSCI Germany})}\right)$$

Whereas a wealth relative (>1) indicates an outperformance of the benchmark, a wealth relative of (<1) accordingly indicates an underperformance (e.g., a WR of 0,9 indicates a 10% underperformance). Again, the natural logarithm of the WR was selected in order to decrease the potential bias by outlying performances.

4.4.3 Total Assets (Firm Size)

In corporate finance, total assets measure total resources of a company and are often used as a proxy for the size of a company. The total assets of companies are measured at the moment they go public. As already discussed, previous literature suggests that the size of a firm is positively correlated to superior long-run performances. It is argued that the greater the firm, the more accurately the initial valuations (offer price) is considered as fair, due to lower informational asymmetries. In order to mitigate the effect of outliers, again, the natural logarithm of total assets is used.

4.4.4 Boom-Bust Period (Business Cycle)

Due to the fact that the sample extends over a period in which different phases of the business cycles were respectively present, the investigation has to take into account the historically prevailing conditions of the market. Hence, he boom-bust period represents a dummy variable that is (=1), if the firm went public during a boom period, and will equal (=0) if the IPO took place during moderate or "bust" periods. By analogy of the mentioned renowned study of Levis (2009), the time frame (January 2000-June 2001) is depicted as the boom period, in which the technology bubble was prevalent. During this time, company and IPO valuations soared to incomparable levels; in which high levels of underperformance in the long run were the consequence of severe initial under-pricing levels in the short run (Loughran & Ritter, 2004).

4.4.5 Price-to-Book Ratio (Firm Type)

The price-to-book ratio is a variable that compares the stock's market value of a company to its book value when the firm goes public. The ratio therefore expresses whether a companies stock is over- or undervalued. Whereas high price-to book ratios can be categorized as growth stocks, low price to book values indicate a value stock. Literature suggests that value stocks outperform growth stocks so that it is expected that the price-to-book ratio is negatively correlated to the long-run performance of IPOs.

4.4.6 Asset Turnover (Operational Efficiency)

Asset turnover is a widely used ratio that represents the value of a firms' sales generated in relation to its asset value. Therefore it is often used as an indicator of operational efficiency with that a firm is deploying its assets in generating revenue:

$$\text{Asset Turnover Ratio} = \frac{\text{Net Sales}}{\text{Total Assets}}$$

It is predicted that the asset turnover ratio is positively correlated to the long-run performance of IPOs as firms that superiorly deploy their assets are expected to perform better in the overall market.

4.4.7 Margin (EBITDA)

The most widely used indicator of the profitability of a company is the EBITDA (Note 15)-margin as it very suitable for performance comparisons due to the fact that it is independent of capital structure. Margins are always calculated by dividing them by net sales:

$$\text{EBITDA-Margin (\%)} = \frac{\text{EBITDA}}{\text{Net Sales}}$$

Similarly to the asset turnover ratio, the EBITDA-margin variable is expected to have a positive correlation towards long-run IPO performance, as companies with a higher profitability are expected to perform simultaneously better.

4.4.8 Debt-to-Assets Ratio (Leverage Ratio)

The leverage ratio is a variable that represents with how much debt (in %) a company is financed. As a high leverage is a key aspect within an LBO valuation, the variable should be definitely considered in the forthcoming valuation. According to literature however, views about the effect of leverage on long-run IPO performance are obscure. Whereas some researchers (e.g., Levis) argue that a higher leverage as a rule increases the stocks earnings per share and is therefore positively correlated to IPO performance, other researchers investigated opposite findings.

4.4.9 Type of Ownership

The overall sample and the investigation of data are conducted by the separation of IPOs into three categories: non-backed, private equity backed and venture capital backed. For the upcoming multivariate regression however, distinctive variables are defined in order to analyse the data in detail:

SB represents a dummy variable, which is equal to 1, if the IPO can be considered as sponsor backed (Note 16) and equals zero, if a financial sponsor does not back the IPO. In this case, it is presumed that professional ownership by a financial sponsor applies the same logic in valuation and value creation and is therefore harmonized within the SB-variable.

The descriptive PE-variable equals 1, of the IPO is backed by a private equity sponsor and equals zero, if this is not the case. Similarly to the PE-variable, the descriptive VC-variable is denoted with 1, in case the IPO is backed by a venture capitalist, and takes the value of zero, if the IPO is either backed by a private equity firm or no financial sponsor.

Based on Hypothesis 2, it is expected that sponsor-backed IPOs outperform their non sponsor-backed

counterparts in the long-run. Furthermore it is anticipated that private equity backed stocks will outperform venture capital backed stocks due to already stated reasons of size, maturity and reputation on the capital markets.

4.5 Methodology—Multivariate Regression

Apart from the investigation of IPO performance against a certain benchmark by applying the BHAR method, the investigation targets the evaluation and analysis of performance difference amongst IPO groups and the reasoning behind that. Therefore the previously stated variables have been identified which may all have a certain influence on the initial valuation on the companies that went public on the stock market which in turn may influence the IPO performances in the long run.

Therefore multivariate regressions for the entire sample will be deployed that target to identify the relationship between distinctive variables and according long-run performance. In total two regressions will be conducted, whereas the respective regressions are split into two slightly different equations, thereby applying the same logic and methodology as in the study of Levis (2009).

The first regression aims to identify how the characteristics of the companies that went public influenced and shaped the respective aftermarket performances. The natural logarithm of the 36-months wealth relative computes the IPO performance against its benchmark. The meanings of all remaining variables have been explained in detail in the variable section (4.4.1-4.4.9) and signify IPO characteristics, important for the initial valuation and long-run performance analysis.

Regression 1_{SB}

$$Log\ Wealth\ Relative_{nt} = x_0 + x_1 initial\ return_{nt} + x_2 \log total\ assets_{nt} + x_3\ price - to - book_{nt} + x_4\ boom - bust\ period_{nt} + x_5\ SB_{nt}$$

Regression $1_{PE\&VC}$

$$Log\ Wealth\ Relative_{nt} = x_0 + x_1 initial\ return_{nt} + x_2\ log\ total\ assets_{nt} + x_3\ price - to - book_{nt} + x_4\ boom - bust\ period_{nt} + x_5\ PE_{nt} + x_6\ VC_{nt}$$

Whereas regression 1_{SB} analyses the aftermarket performance of sponsor-backed IPOs, in general, regression $1_{PE\&VC}$ analyses the performances even more filigreed as it distinguishes among the type of financial sponsoring, thereby subdividing the performances into private equity and venture capital sponsoring.

The second regression aims to integrate operational performance metrics into the performance analysis. Therefore the three identified variables with operational characteristics (asset turnover, EBITDA-margin, leverage ratio) will be added to the previous equations. Hence, the investigation target is to identify whether the operational efficiency, capital structure and economic performance has an influence on the long-run performance of IPOs within the German market:

Regression 2_{SB}

$$Log\ Wealth\ Relative_{nt} = x_0 + x_1 initial\ return_{nt} + x_2\ log\ total\ assets_{nt} + x_3\ price - to - book_{nt} + x_4\ boom - bust\ period_{nt} + x_5\ asset\ turnover_{nt} + x_6\ EBITDA - margin_{nt} + x_7\ leverage\ ratio_{nt} + x_8\ SB_{nt}$$

Regression $2_{PE\&VC}$

$$Log\ Wealth\ Relative_{nt} = x_0 + x_1 initial\ return_{nt} + x_2\ log\ total\ assets_{nt} + x_3\ price - to - book_{nt} + x_4\ boom - bust\ period_{nt} + x_5\ asset\ turnover_{nt} + x_6\ EBITDA - margin_{nt} + x_7\ leverage\ ratio_{nt} + x_5\ PE_{nt} + x_6\ VC_{nt}$$

Once again, the second regression consists of two equations. Regression $2_{PE\&VC}$ subdivides the general term of sponsor-backing into private equity and venture capital sponsoring in order to investigate performance patterns across different IPO groups.

5. Result Presentation

5.1 Sample Outline

5.1.1 Distribution and Categorization of IPOs in Germany

The ultimate sample that provides the basis for the analysis of IPO performances consists of 286 IPOs on the German market between the years 2000-2013. From the total sample size of 286, 84% (240 IPOs) are non-backed by a financial sponsor. From the remaining 16%, 21 IPOs (7%) are private equity backed, while 25 IPOs (9%) are backed and financed by venture capital firms. Therefore it can be said that the sample has a quite comparable amount of venture capital-backed and private equity-backed IPOs.

Table 1. Annual Distribution and Categorization (Note 17) of IPOs in Germany

IPOs in Germany (FY 2000-FY 2013)					
Year	**NB**	**SB**	**PE**	**VC**	**Total**
2000	109	2	0	2	111
2001	20	0	0	0	20
2002	6	0	0	0	6
2003	1	0	0	0	1
2004	4	0	0	0	4
2005	1	8	3	5	9
2006	30	13	5	8	43
2007	32	11	4	7	43
2008	1	2	2	0	3
2009	3	0	0	0	3
2010	10	3	2	1	13
2011	10	4	3	1	14
2012	8	0	0	0	8
2013	5	3	2	1	8
Total Sum	**240**	**46**	**21**	**25**	**286**

By looking at the table, two important patterns can be observed: on one hand it can be seen that the technology bubble in the year 2000 triggered an enormous demand to go public, so that about 39% of past IPOs in Germany between 2000-2013 have been registered in the year 2000, which is an extraordinary high number. On the other hand the table signifies the positive correlation between bull market conditions and IPO number. Hence, apart from a high number of IPOs during the technology bubble, the soaring economy especially in 2006-2007, showed also high levels of firms going public (43 IPOs respectively). Overall it can be said that this depiction is already in alignment with the theory of "Market-Timing Theories".

5.1.2 Industry Classification of IPOs in Germany

Apart from a division and classification of the sample in total numbers over the investigated period (2000-2011), the sample can be classified into the industries defined by the FTSE industry classes in Table 2:

Table 2. Industry Classification of IPOs in Germany

IPOs in Germany—Classified by Industry (%) (FY 2000-FY 2013)					
Industry	**NB**	**SB**	**PE**	**VC**	**Total**
Oil & Gas	5.8%	13.0%	9.5%	16.0%	18.8%
Basic Materials	2.9%	6.5%	14.3%	0.0%	9.4%
Industrials	19.2%	26.1%	28.6%	24.0%	45.3%
Consumer Goods	7.1%	13.0%	28.6%	0.0%	20.1%
Health Care	7.1%	13.0%	4.8%	20.0%	20.1%
Consumer Services	11.7%	6.5%	9.5%	4.0%	18.2%
Telecommunications	1.3%	0.0%	0.0%	0.0%	1.3%
Utilities	1.7%	2.2%	4.8%	0.0%	3.9%
Financials	17.1%	2.2%	0.0%	4.0%	19.3%
Technology	26.3%	17.4%	0.0%	32.0%	43.7%
Total Sum	**100%**	**100%**	**100%**	**100%**	**100%**

This table clearly identifies that in Germany, IPOs were especially conducted within the industrials- (45.3%) and technology sector (43.7%), which make up for about 89% of all IPOs. This observation is in alignment with the fact that Germany is economically very strong with regard to the industrial and technological sector.

By analysing the industry distributions within the distinctive financial sponsoring alternatives, it can be ascertained that IPOs with private equity backing especially prevail in the consumer goods- and industrial sector (28.6% respectively). This pattern is a sign for firms, which are usually considered as rather mature, and foreshadows a potential strategy of a rather short investment horizon, typical for private equity investors.

IPOs with the financing background of venture capital firms on the other hand, tended to invest especially in the technology- (32%), industrial- (24%) and health care (20%) sector. Especially the health care and technology sector are typically industries that demand strong investments into research and development, which are filled by a strong venture capitalist that aims to finance these firms already in their early phases.

5.1.3 Firm & Operational Characteristics of IPOs in Germany

Apart from classifications according to industry and general annual IPO distributions, the data set has been examined according to the operational and firm characteristics of the respective financial IPO groups. This distinction is considered as important with regard to a detailed analysis especially targeting to distinguish among the existing IPO types. Therefore, apart from the operational variables identified in section 4.4 (total assets, asset turnover, EBITDA-margin, leverage-ratio), firm data that is capable of giving an estimate about firm size (number of employees, net sales, market cap) has been added to the analysis (Table 3).

Therefore the respective medians, which have been used in order to guarantee a good estimate for the sample average, source from different sample pools, according to their present availability. Considering characteristics of firm size, it can be depicted that there exists a huge difference amongst the respective IPO groups.

Whereas non-backed and venture capital-backed companies show a quite comparable median of €110.1 million and €157.5 million respectively with regard to market capitalization, companies backed by private equity are significantly larger (€466.0mn). This huge difference in size is also very observable by considering the number of employees where private-equity backed companies (median employee number = 3154) outweigh their VC-counterparts by 15x (210) and their NB-counterparts even by 19x (165).

Table 3. Overview of Median Firm Size- and Operational Characteristics of IPOs in Germany

Median Firm Size & Operational Characteristics of IPOs in Germany (FY 2000-FY 2013)				
Category	**NB**	**SB**	**PE**	**VC**
Market Cap (in € Mio.)	110.1	274.2	466.0	157.5
Net Sales (in € Mio.)	26.4	159.8	581.7	42.9
Total Assets (in € Mio.)	58.9	175.9	558.3	83.6
Employee Number (#)	165	769	3154	210
EBITDA (in € Mio.)	3.2	17.8	75.1	8.4
EBITDA Margin (in %)	11.1%	11.9%	12.8%	9.6%
Asset Turnover (x)	0.5	0.8	1.2	0.6
Leverage Ratio (in %)	4.8%	11.5 %	25.3%	0.8%
Price-to-Book Ratio (x)	3.1	3.4	2.8	3.6

Considering the comparison of private equity backed IPO firms and their non-backed counterparts, a similar pattern can be observed regarding net sales and total assets in which PE-backed IPOs are 22x and 10x larger than their non-backed counterparts. When comparing net sales and total assets of the venture capital-backed IPOs to their non-sponsored counterparts, the differences are significantly lower (1.6x and 1.4x correspondingly), implying again similar company sizes of the two IPO groups.

When analysing operational characteristics, it can be seen that the EBITDA-margin is highest (12.8%) for IPOs that have been backed by a private equity firm although VC-backed (9.6%) and non-backed IPOs (11.1%) just slightly underperform in this category. Furthermore it can be seen that companies that went public, backed by a private equity firm show a higher operational efficiency in terms of asset turnover (1.2) compared to VC-backed (0.6) and non-backed (0.5) IPOs.

The leverage ratio on the other hand shows significant differences amongst the respective IPO groups. Whereas companies that went public, financed by private equity firms showed a median leverage ratio of 25.3%, non-backed IPOs and VC-backed IPOs showed drastically lower levels of about 5% and 1% respectively. This unexpected result implies that companies that went public, financed by venture capital firms, have nearly no debt. The reason behind that might be that the investments of venture capitalists that generally have a high-risk profile are too risky for the debt capital markets, so that banks are rather reluctant to finance these IPOs in the past, so that they solely rely on equity.

By looking at the price-to-book ratio, it can be identified that PE-backed IPOs show the lowest ratio (2.8) compared to the VC-backed (3.6) and non-backed (3.1) counterparts. This rather unexpected result might be explained by the fact that all the IPOs that were conducted during the technology bubble in 2000 have not been backed by a financial sponsor. Therefore the overvaluation during that time leads to a positively skewed data set of non-backed IPOs.

Conclusively it can be said that PE-backed IPOs are distinctively larger in terms of size compared to their VC-backed and non-backed counterparts. Furthermore, IPOs that went public with the sponsoring of a private equity firm tend to perform, on average, operationally more efficient than the two other IPO groups and have a higher leverage ratio, whereas VC-backed and non-backed IPOs show rather comparable results with respect to size and operational characteristics.

5.2 Sample Analysis—Short Run Performance of IPOs

As discussed in the literature review, the magnitude of IPO under-pricing, a phenomenon that was approached by various researchers in the past, depends on numerous factors such as asymmetric information as well as on firm- and market-specific characteristics (see section 2.4.1(a)-2.4.1(c)). Similar to the positive correlation between the states (Note 18) of the economy and the number of companies that go public, the magnitude of IPO under-pricing in Germany also shows a high fluctuation over time (see Figure 4).

Figure 4 depicts the annual average level of under-pricing of all the 286 IPOs that are under investigation between the years 2000-2013. The first observation that can be made is the very high level of under-pricing (41,5%) during the technology bubble in 2000. Moreover it is visible that the

under-pricing levels are quite correlated to the economic states, as apart from the technology bubble, high under-pricing levels can also be discovered just before the financial crisis (2004-2007). Therefore it can be said that the identified under-pricing data is confirming the findings of the previously discussed literature, stating that under-pricing magnitude follows conditions of the economy, expecting it to increase steadily since 2011.

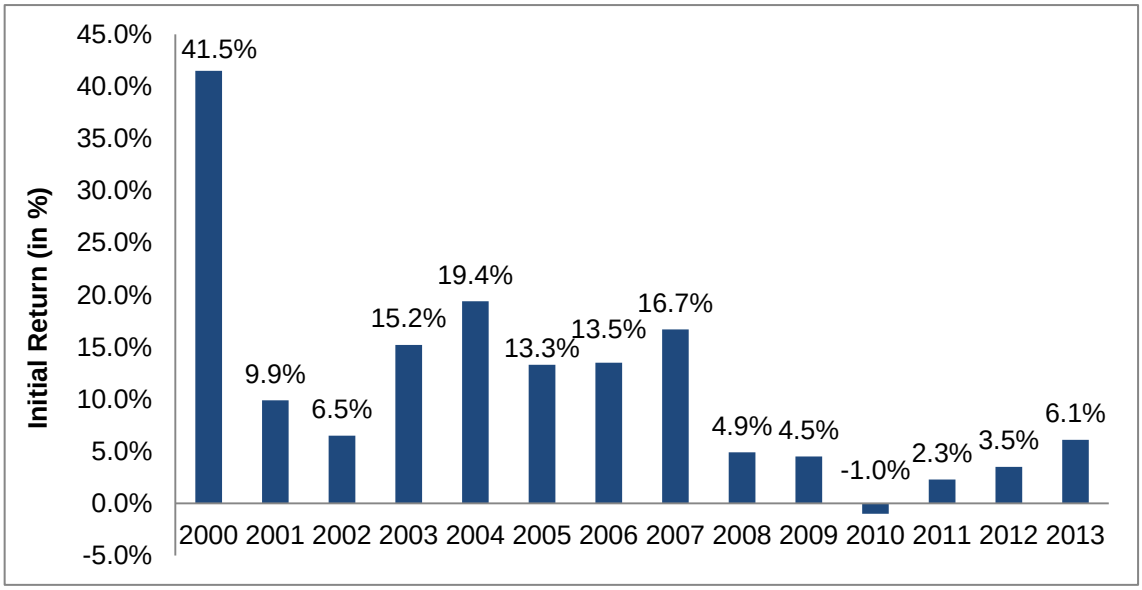

Figure 4. Average Annual Under-pricing of German IPOs (2000-2013)

In order to provide a more detailed view on the under-pricing levels, especially in the form of a summarized comparison between the respective IPO groups, Table 4 provides data that represents the averages and medians of under-pricing on the German market for the distinctive IPO groups.

Table 4. Under-Pricing Magnitude of Respective IPO Groups in Germany

Category	NB	SB	PE	VC
Total IPO Number (#)	240	46	21	25
Average (in %)	24.1%	10.5%	3.9%	16.8%
Median (in %)	3.2%	2.8%	1.4%	4.1%
Standard Deviation (in %)	62.5%	26.3%	8.9%	35.8%

By looking at Table 4 it can be seen that the average under-pricing levels in the German market confirm the general tendency of research results discussed in past literature: sponsor-backed IPOs are less under-priced (10.5%) compared to non-sponsor-backed IPOs (24.1%).

This difference may be justified by the fact that sponsor-backing acts as a sign of quality, reducing

valuation uncertainty for potential investors, thereby decreasing initial first-day returns. Whereas PE-backed IPOs show a very low average under-pricing level (3.9%), implying fairly accurate pricing, VC-backed IPOs show distinctively higher initial first-day returns (16.8%), nevertheless lower than the non-sponsor backed IPOs (24.1%).

The reason for very high under-pricing of non-sponsored IPOs may be explained by the technology bubble within the year 2000, in which alone about half of all non-sponsored IPOs (109) were conducted. Soaring valuations and related high and volatile under-pricing levels, visible by the very high standard deviation (62.5%), were prevailing during that time.

Conclusively it can be said that, ceteris paribus, in Germany the under-pricing phenomena of IPOs is existent and with respect to the market-timing theories in alignment with movements of the German economy following the business cycle, leading to higher under-pricing levels during boom and bubble periods.

5.3 Sample Analysis—Long Run Performance of IPOs

In order to enable the confirmation or rejection of Hypothesis 1-2, the long-run performance of IPOs within the German market was investigated. The time frame under investigation, aiming to identify the equally weighted as well as the value weighted buy-and-hold abnormal returns of IPOs, starts after the first trading date, and persists until 36 months month after the firm went public. The equally- and value weighted BHAR were calculated against various benchmarks. These applied benchmarks are country- (MSCI Germany), size- (DAX30, MDAX, SDAX) and industry-specific (FTSE) and set the performance of the IPOs under investigation into a context towards the respective indices.

The result is a post-launch performance analysis that aims to depict the various performance patterns of the distinctive IPO groups over the stated three-year horizon and is demonstrated by Table 5. Considering the entire IPO sample (Sample 1), it can be seen that German IPOs, on average, heavily underperform the selected benchmarks. By equally weighting the BHARs within the three-year period, the negative returns range from -29% to -34% (36 months after the IPO). Additionally, the results from Sample 1 show a significance level (Note 19) of 1%, indicating that the results are highly significant even after the skewness adjusted t-statistics (Johnson, 1978).

Table 5. BHARs for IPOs in Germany

Buy-and-Hold Abnormal Returns for German IPOs (FY2000-FY2013)						
Benchmark	Country (MSCI Germany)	Size (Dax30, MDAX, SDAX)	Industry (FTSE)	Country (MSCI Germany)	Size (Dax30, MDAX, SDAX)	Industry (FTSE)
Months	Sample 1: **Total**-IPOs in Germany					
12	-25%***	-25%***	-23%***	-16%***	-15%***	-13%***
	(-4.52)	(-4.03)	(-4.21)	(-4.20)	(-4.87)	(-4.23)

24	-30%***	-31%***	-29%***	-12%***	-14%***	-15%***
	(-4.10)	(-4.01)	(-5.34)	(-4.63)	(-4.77)	(-3.88)
36	-29%***	-34%***	-31%***	-5%***	-9%***	-15%***
	(-4.93)	(-5.74)	(-5.42)	(-4.66)	(-4.79)	(-4.03)
Months	Sample 2: **NB**-IPOs in Germany					
12	-26%***	-27%***	-24%***	-16%***	-15%**	-10%**
	(-4.33)	(-4.22)	(-3.74)	(-2.06)	(-2.89)	(-1.95)
24	-32%**	-33%***	-33%***	-12%*	-17%**	-13%***
	(-3.12)	(-3.43)	(-5.14)	(-1.36)	(-2.70)	(-3.35)
36	-29%***	-35%***	-31%***	-5%	9%	-11%**
	(-4.37)	(-3.75)	(-4.64)	(-1.01)	(-1.54)	(-2.54)
Months	Sample 3: **SB**-IPOs in Germany					
12	-15%	-10%	-14%	-22%*	14%	15%*
	(-1.35)	(-1.55)	(-1.04)	(-1.73)	(-1.54)	(-0.78)
24	-21%	-10%	-14%	14%	12%	10%
	(-1.22)	(-1.67)	(-1.19)	(-2.01)	(-0.42)	(-0.46)
36	-25%**	-10%	-22%**	-9%	-4%	-7%
	(-1.98)	(-1.92)	(-2.31)	(-0.88)	(-0.51)	(-0.69)
Months	Sample 4: **PE**-IPOs in Germany					
12	-16%	-12%	-17%*	-23%	-17%	-20%
	(-1.98)	(-1.22)	(-1.73)	(-1.65)	(-1.90)	(-1.62)
24	-23%**	-15%**	-25%**	-17%	-15%	-15%
	(-2.30)	(-1.64)	(-2.53)	(-0.74)	(-0.77)	(-1.01)
36	-6%	6%	-10%	1%	10%	-3%
	(-0.39)	(0.56)	(-0.58)	(-0.13)	(0.65)	(0.00)
Months	Sample 5: **VC**-IPOs in Germany					
12	-17%	-11%	-7%	-20%	-10%	-10%
	(-1.94)	(-0.22)	(-0.60)	(-1.45)	(-0.83)	(-0.87)
24	-22%	-9%	-7%	-14%	-5%	2%
	(-1.53)	(-0.43)	(-0.71)	(-1.74)	(-0.74)	(0.09)
36	-38%**	-26%	-22%**	-33%***	-24%*	-21%**
	(-2.54)	(-1.50)	(-2.11)	(-3.50)	(-2.63)	(-2.44)

Therefore it can be said that the findings confirm the overall tendency of previously conducted studies, that IPOs underperform their benchmarks in the long run.

Due to the fact that the majority of the data stems from non-sponsored IPOs (84%), the underperformance of returns for the non-backed sample (Sample 2) is expectedly very similar to

sample 1, ranging from -29% to -35%. Despite the circumstance that Sample 3, which summarizes the performances of sponsor-backed IPOs, also shows negative returns ranging from -10% to -25%, the performance is considerably better compared to the non-sponsored IPOs.

Hence, comparing the equally weighted performance of sponsor-backed and non-sponsor backed IPOs, it can be said that although both samples show a negative performance, sponsor-backed IPOs perform about 4% to 25% better than their non sponsor-backed counterparts.

An interesting difference between private equity backed (Sample 4) and non sponsor-backed IPOs (Sample 2) that can be observed is the performance over the entire event window. Whereas Sample 2 shows a quite steady underperformance level over the three-year period (12 months: -24% to -27%; 24 months: -32% to -33%; 36 months: -29% to -35%), the performance of Sample 4 improves over the investigated time horizon (12 months: -12% to -17%; 24 months: -15% to -25%; 36 months: -10% to 6%). This performance improvement may indicate that the private equity firms are able to reduce informational asymmetries for investors over time that increase the returns on the stock exchanges.

Sample 4 and Sample 5 investigate and separate the performances of financial sponsoring of IPOs. In fact the performances between private equity backed and venture capital backed IPOs highly varies. While PE-backed IPOs show return figures around zero, after 36 months, which amount to -10% to 6%, venture capital backed IPOs significantly underperform with negative return figures ranging from -38% to -22%. Therefore it can be said that the negative performance of sponsor-backed IPOs is primarily driven by venture capital backed IPOs, despite the fact that, on average, they still show lower negative returns than non-sponsor backed IPOs.

When considering value-weighted returns instead of equally weighted BHARs, the entire IPO sample (Sample 1) shows significantly better results, with a reduced magnitude of negative returns, ranging from -5% to -15%. A similar pattern holds true when looking at the value weighting of private equity-backed IPOs, which show a performance range between -3% to 10%. By looking at the venture capital sample (Sample 5) however, the value-weighted results still imply highly negative BHARs, which range from -21% to -33%. Hence it can be said that the majority of negative IPO performances originates from smaller companies, which are primarily backed by venture capital firms or no sponsor. Therefore the theory prompted by Brav and Gompers (1997), stating that value-weighting leads to more consistent data, in which large companies dominate, seem to be visible in the underlying data set.

Finally it can be said, that the samples mirror the tenor of previous literature, an underperformance of IPOs compared to the respective benchmark indices. Therefore Hypothesis 1 can be confirmed by the underlying data set. Moreover, the sample indicates that especially the private equity backed IPOs seem to outperform the non sponsor-backed sample although this may not hold true for the venture capital backed IPOs. However as sponsored IPOs overall slightly outperform non-sponsor backed IPOs, it can be ascertained that Hypothesis 2, exactly assuming this pattern, can be confirmed as well.

5.4 Sample Analysis—Annual Performance Patterns of German IPOs

Market-timing theories, which have been discussed in the literature review (2.3.1), assume that IPOs

generally tend to cluster around bull market conditions. Furthermore it is assumed that companies even postpone IPOs in order to issue their stocks on the equity market during favourable market conditions during the favourable market conditions (Lucas & McDonald, 1990).

Figure 5 depicts the relationship between the issuing activities of IPOs during the investigated period (2000-2013) expressed in terms of the number of IPOs together with the MSCI Germany index, a representative benchmark for the performance of the German equity market.

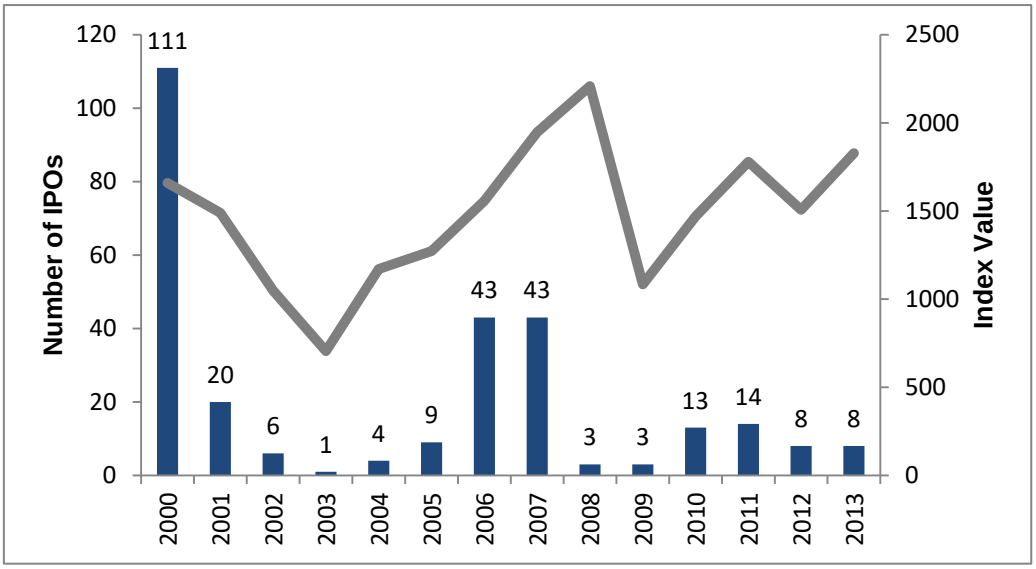

Figure 5. Annual IPO Number and Country Index Development (2000-2013)

By looking at Figure 5 it can be seen that indeed, issuing activity is highly correlated to conditions of the equity market. During the technology bubble in 2010 as well as in the years just before the severe financial crisis (2006-2007), IPO issuing activity shows by far the highest levels over the examined period. Hence, it can be assumed that the analysed data is in alignment with the previous findings over market timings of IPOs. However according to the theory, the IPO levels should have recovered especially in the last three years under investigation (2011-2013) until now (2017), due to favourable market conditions with steadily rising indices (Note 20).

This stated phenomenon might be explained by the study of Weild and Kim (2010), which suggests that financial sponsors increasingly decide to exit their most promising portfolio enterprises via a trade sale instead of an IPO because of changes within the regulatory environment, leading to a so-called “IPO crisis”. The financial sponsors see a higher chance of a successful exit through a trade sale, so that the general behaviour of private equity and venture capital firms have shifted away from choosing IPOs as a exit strategy to sell their stake of equity. A further reason for the diminishment of IPO activity, especially backed by a financial sponsor, might be the fact that young and dynamic growth firms have already been acquired by mature and established firms which consequently leads to a lower IPO activity (Bessler, 2012).

In order to extend the observed relationship between the issuing frequency and the index value towards a performance based IPO analysis, the long-run performance of IPOs was investigated on an annual basis. Table 5 illustrates the BHARs for the 36 months period of IPOs in Germany on an annual basis, ranging from the year 2000 to 2013. The distinctive returns are calculated by the monthly compounding of returns for three years, starting for the individual IPOs after they went public. As a performance benchmark, the MSCI Germany was selected.

Table 5. The Three-Year BHARs of IPOs on an Annual Basis

Three-Year BHARs of IPOs in Germany (FY2000-FY2013)						
Year	**# Of IPOs**	**TOTAL**	**NB**	**SB**	**PE**	**VC**
2000	111	-53%	-52%	-56%	N.A.	-56%
2001	20	-48%	-49%	-89%	N.A.	-89%
2002	6	-45%	-71%	13%	23%	-5%
2003	1	112%	112%	N.A.	N.A.	N.A.
2004	4	14%	24%	-10%	-10%	N.A.
2005	9	-8%	-10%	-1%	4%	-10%
2006	43	-29%	-30%	-29%	-6%	-34%
2007	43	-34%	-39%	-30%	-27%	-41%
2008	3	-19%	-26%	6%	2%	5%
2009	3	-21%	-21%	N.A.	N.A.	N.A.
2010	13	-26%	-38%	-11%	25%	-33%
2011	14	-56%	-56%	N.A.	N.A.	N.A.
2012	8	-23%	-25%	-11%	-7%	-13%
2013	8	-23%	29%	-18%	-3%	-29%

Discussed literature suggested that firms that go public during bull market conditions with rather heavy issuing performance, the stocks are usually overvalued, leading to a underperformance compared to years in which less IPOs are conducted. Thus, it is expected that the data set shows a higher underperformance magnitude during bull market conditions and a comparatively lower degree of underperformance during bear market conditions.

The data of Table 5 actually support the assumption of the relationship between the long-run IPO performances and the issuing activity by firms. Highest total performances are identified in the years 2003-2005, ranging from -8% to 112%. These years belong to years with rather low issuing activity (1-9 IPOs). On the other hand, underperformance is among the greatest during the technology bubble in 2000 (-53%) and just before the financial crisis in the years 2006-2007 where negative returns amounted -29% to -34%. The year 2011 also represents a year of high underperformance with a

negative return of about -56%.

By comparing performances within the IPO groups, it can be recognized that whereas non-sponsor backed IPOs performed better than sponsor-backed IPOs between the years 2000-2005, the results twisted between 2006 to 2012, as sponsor-backed companies performed better within this period. This phenomenon can be explained by the fact that during the first five years under investigation, nearly all the sponsor-backed IPO activity can be attributed to venture capital firms, which heavily underperformed in these respective years.

When measuring the performance of private equity backed IPOs against non-sponsor backed IPOs, private equity sponsored IPOs almost always outperform their counterparts, except for the years 2004 and 2013. Therefore it can be said that on the first view, sponsor-backed and non-sponsor backed performance may seen to be equalized. When however considering the IPO groups in more detail it can be seen that, on average, PE-backed IPOs outperform their counterparts, whereas VC-backed IPOs perform similarly to non-sponsor backed IPOs or even worse.

One obvious limitation of the table is the unequal distribution of IPO numbers and IPO group inequalities, which skew the results in a first sight. Therefore it has to be ascertained that most of the IPOs were conducted during the technology bubble and most of the IPOs have a non-sponsored background, distorting the findings especially when looking at total numbers.

5.5 Sample Analysis—Multivariate Regression Analysis for IPOs with Financial Sponsoring Background

So far the underlying data analysis has identified that sponsor-backed IPOs have outperformed non-sponsor backed in the analysed three-year period after going public. This superior performance primarily originates from private equity backed IPOs, which, on average, consist of rather large companies with comparatively great performances compared to the IPOs, backed by venture capitalists.

To enable the identification of factors that cause the respective differences in performances, one methodology, discussed in section (4.5), is the establishment of a multivariate regression that targets to identify the relationships between the IPO performance and selected company characteristics, depicted by Table 6.

Whereas Regression 1 captures general IPO characteristics that were prevalent at the time of offer (initial return, logarithm of total assets, price-to-book ration, boom-bust period), Regression 2 extends the stated characteristics by operating levers (asset turnover, EBITDA-margin, leverage ratio). The two regressions are both separated into Sponsor-Backed (SB) performances and a more detailed view by separating the sponsor backing into private equity and venture capital (PE&VC).

5.5.1 Regression Results—Financial Sponsoring

By looking at the regression results it can be seen that Table 6 confirms the previous findings, stating that sponsor-backed IPOs perform superiorly to their non-backed counterparts. Both regressions (1SB & 2SB) show a positive SB-coefficient (1SB: 0.482***; 2SB: 0.365***), with the highest significance level of 1%, implying that the firms that go public, backed by a financial sponsor show a comparatively

high aftermarket performance (36 months).

When going into the more detailed regressions (1PE&VC & 2PE&VC), it is visible that especially the sponsoring by private equity firms has a very positive and highly significant effect on the aftermarket performance of IPOs. Therefore it can be said that the analysis is in close alignment to the previously identified tendencies, confirming a positive correlation between financial sponsoring and IPO long-run performance.

5.5.2 Regression Results—General Characteristics

Considering the coefficient of the initial average IPO return on the first trading date, it can be seen that the figure is negative within each equation of the respective regressions. This implies a negative correlation between the initial return and the aftermarket performance. This would consequently strengthen the research findings by Ritter (1991) and other researchers, depicting the mean reverting characteristic of IPOs: the higher the first-day under-pricing, the greater the underperformance in the long run, reverting towards the mean.

Table 6. Multivariate Regression Analysis of German IPOs

Multivariate Regression Analysis of German IPOs (FY2000-FY2013)				
Variables	Regression 1SB	Regression 1PE&VC	Regression 2SB	Regression 2PE&VC
General Characteristics				
Initial Return	-0.481**	-0.452**	-0.468**	-0.473%**
	(-2.52)	(-2.71)	(-2.20)	(-2.69)
Log Total Assets	0.222***	0.205***	0.323***	0.338***
	(3.10)	(3.54)	(4.43)	(3.95)
Price-to-Book Ratio	-0.116***	-0.115***	-0.112***	-0.112***
	(-2.67)	(-2.94)	(-3.01)	(-2.99)
Boom-Bust Period	-1.047***	-1.047***	-0.992***	-0.990***
	(-4.56)	(-4.56)	(-4.83)	(-4.24)
Operating Characteristics				
Asset Turnover			0.645***	0.662***
			(5.03)	(4.86)
EBITDA-Margin			0.195***	0.201***
			(3.31)	(3.34)
Leverage Ratio			0.171**	0.203**
			(2.94)	(3.70)
Financial Sponsoring (IPO Group)				
Sponsor-Backed (SB)	0.482***		0.365***	

	(3.84)	(2.89)
PE-Backed	0.561***	0.463***
	(2.59)	(2.10)
VC-Backed	0.187**	0.176**
	(2.20)	(2.11)

*Significant at 10% (0.1 significance level), **Significant at 5% (0.05 significance level), ***Significant at 1% (0.01 significance level).

The logarithm of total assets, a characteristic that aims to represent the size of an IPO, shows a positive and significant relationship towards the long run performance of IPOs. That would imply that the larger a company, the better the performance in the aftermarket. Exactly this phenomenon has been discussed in the study of Brav and Gompers (1997), which states that larger companies are less volatile than smaller companies and therefore perform better. In the underlying sample this is precisely the case with private equity backed IPOs that are on average larger firms that perform comparatively better than the rest of the overall sample.

A further coefficient under investigation in the regression is the price-to-book ratio, which is negatively correlated to long-run IPO performance, according to the sample (Table 6). Whereas high price-to-book ratios imply a growth stock, low price-to-book ratios indicate a value stock. Due to the fact that high price-to-book values already entail a high valuation based on rather risky determinants, the performance is often lower due to a higher stock volatility, leading to the discussed negative relationship.

The boom-bust period variable has also a negative coefficient with regard to the IPO long-run performance, demonstrating that within boom periods, such as the technology bubble in the year 2000 or the years 2006-2007 just before the financial crisis, were times in which stock valuations, on average, were heavily overpriced. Therefore in these “windows of opportunity”, high under-pricing and the following gradual mean reverting characteristic of IPOs lead to poor levels of IPO performance, justifying the negative relationship.

5.5.3 Regression Results—Operational Characteristics

By looking at the operational characteristics of companies that went public, the following characteristics can be ascertained:

The asset turnover ratio, which represents an approximation for the operational efficiency of firms, is positively related to the aftermarket performance of IPOs. Due to the fact that higher operational efficiency should normally lead to a superior performance, the regression result sounds reasonable and is in close alignment to economic theory.

A further operational variable, the EBITDA-margin, also has a positive effect on the performance of IPOs with a significance level at 1%, implying high reliability. As the EBITDA-margin is an indicator of a firm’s profitability, the positive correlation is a further obvious and reliable indicator that certifies

the data is meaningful and highly relevant.

The leverage ratio, a key feature that is especially considered by private equity firms, when evaluating the attractiveness of an investment of a potential target, pronounces the positive relationship between leverage and long-run performance of IPOs. Levis (2011) already discussed the role and positive influence on leverage within his study of European IPO performance.

In summary, it can be said that the underlying results of the multivariate regression show a very close alignment with findings of previous literature by various researcher. The data simply suggests that a financial sponsor, with regard to the German market, especially in form of a private equity investor, has a positive influence on the investigated long-run IPO performance of three years, following the data of going public. This positive influence is backed by a high statistical significance, underlining the validity of the analysed data on the IPO equity capital market in Germany.

6. Result Discussion

The result discussion section aims to create a linkage between the discussed findings by various researchers, presented in the literature review, and the results observed within the course of investigation of this study. In order to provide a precise overview of all the relevant and important findings of the underlying data sample, consisting of 286 IPOs on the German market within the years 2000-2013, the results are summarized below:

- Except for the year 2010, on average, all investigated IPOs are under-priced. The level of under-pricing is highly volatile and shows a positive relationship to bull market conditions, thereby depicting the highest under-pricing values during the technology bubble (2010) and just before the financial crisis (2004-2007). Private equity backed IPOs are significantly less under-priced than their venture capital- and non sponsor-backed counterparts.
- With regard to the selected country-, size-, and industry benchmarks, on average, all investigated IPOs on the German market, underperform their respective market indices in the long run, confirming Hypothesis 1 of this study. Overall, long-run underperformance of IPOs, measured by BHARs, was highest during the technology bubble, followed by the time span just before the financial crisis.
- On average, IPOs that are backed by a financial sponsor perform superior to firms that go public without financial sponsoring, thus supporting and confirming Hypothesis 2. The greater performance is primarily driven by IPOs that are backed by a private equity firm, which represent in terms of size and operational performance the most distinctive and highest results. Financial sponsoring by a venture capitalist however, shows clearly lower performances, comparable to companies that went public without being backed by a financial sponsor.
- By looking at the overall developments of the past years, it may be assumed that financial sponsors, and firms in general, tend to dissociate from choosing IPOs as their exit route, inter alia, due to very high involved transaction costs and the inflexibility of financial sponsors to exit the company compared to other exit channels.

7. Conclusion

The underlying paper investigated the overall market performance of initial public offerings in Germany by analysing the long run performance of IPOs by utilizing the latest (Note 21) available data, ranging from 2000-2013. The analysed data set overall consists of 286 IPOs, out of which 46 can be regarded as IPOs that were backed by a financial sponsor (PE: 21; VC: 25). The aim was not only to identify how IPOs perform against their benchmark categories (country, industry, and size), but also to depict and distinguish between performance patterns for any of the examined IPO groups, with a special focus on the IPOs backed by financial sponsoring. Apart from the measuring of initial first-day returns, in order to identify whether IPOs are under-priced, and the compounding of buy-and-hold abnormal returns to analyse the 36 months aftermarket performance of IPOs, a multivariate regression has been run attempting to understand the influence factors (e.g., operational and size characteristics) that led to the respective results of the study.

Furthermore the empirical findings advocate that, in essence, German non-sponsor backed IPOs underperform their financially sponsored counterparts, measured by BHARs within the investigated three year period after the issuance of the particular stocks. Dependent on the benchmark applied, the superior performance of sponsor-backed IPOs ranges between 4% and 25%. Hence, it can also be said, that these findings also enable the confirmation of Hypothesis 2.

Another major finding of the study is the fact that companies deliberately postpone and target to issue their stocks to the public during bull market conditions, visible by soaring IPO numbers during the technology bubble (2000) and just before the financial crisis (2006-2007). Surprisingly, it can be ascertained that under-pricing levels are among the highest in the stated “hot market” periods. Due to the mean reverting characteristic of IPO returns, the long run performances during bull market conditions are among the worst within the investigated data sample, confirming the findings in the study of Ritter (1991). Of certain interest is the fact that the under-pricing levels and related negative performances flattened in the second boom period (2006-2007) compared to the technology bubble. This may imply that investors and financial sponsors have learned from previous market phenomena and related failures and include this knowledge when assessing new investment opportunities.

Conclusively it can be said that in the recent years, choosing IPOs as an exit channel has lost certain attractiveness, visible by stagnating numbers despite recovered economic situation on a global scale. With regard to financial sponsors, Weild and Kim (2010) even suggest an “IPO crisis” due to the fact that especially financial sponsors assess the attractiveness of a trade sale or secondary buyout nowadays as distinctively higher, than the exit via an initial public offering. Main reasons for that tendency are the highly involved transaction cost, a time consuming and strict regulatory requirement as well as multiple IPO performances that fell short their expectations. Although Snapchat has in fact not made any profits so far, its recent successful IPO, which was the biggest US technology IPO since the Alibaba Group Holding Inc in 2014 (Note 22), signifies that IPOs will always be a common and logical next step of a company in order to acquire “fresh” equity.

It remains to be seen how IPO numbers will develop in general, what role financial investors will play in the future with regard to IPOs, and how the under-pricing magnitudes as well as the long run performance of IPOs will evolve on a global-, European- and German level.

7.1 Limitation and Suggestions of Further Research

Despite the fact that the study definitely contributes to the vague and divergent research sphere of the European IPO market, it should be noted that this study solely analyses the performances within Germany. Although Germany is unquestionably a driving financial force in Europe, this study is unable to provide a résumé for the IPO performances of the entire European market. This determination can be made due to the fact that Europe is highly fragmented in terms of regulatory requirements, economic strength, size and significance of the national financial markets so that IPO performances cannot be just generalized or reconciled.

The fact that a great part of IPOs (39%) derives from the year 2000, in which the technology bubble was prevalent, might skew the results towards higher overall under-pricing and lower long run performances. Therefore future research might isolate and compare the effects of the technology bubble. Furthermore, in order to depict potential differences and fragmentations of the European IPO market, future studies could compare and highlight the differences between two or more European countries (e.g., Germany vs. France).

Although this study depicts financial sponsoring in detail, by separating among private equity and venture capital sponsorships, a clear division of the two sponsorship types is often very difficult as the financing types are closely related and often financial sponsors operate within both types of funding.

Finally, it can be said that although this study not only confirms previous findings by various academics but also contributes to the German and European research landscape of IPOs, several global and European markets have not yet been sufficiently analysed. Especially, the role and performance determinants of IPOs backed by financial sponsors, as well as the general development of the attractiveness of IPOs as a future exit channel, could be interesting topics for further research.

References

Achleitner, A. K., Figge, C., & Lutz, E. (2014). Value creation drivers in a secondary buyout—The acquisition of Brenntag by BC partners. *Qualitative Research in Financial Markets*, *6*(3), 278-301. https://doi.org/10.1108/QRFM-06-2012-0018

Arundale, K. (2010). *A guide to private equity*. British Private Equity & Venture Capital Association.

Bain & Company. (2017). *Global private equity report 2017*. Retrieved from http://www.bain.com

Benveniste, L. M., & Spindt, P. A. (1989). How investment bankers determine the offer price and allocation of new issues. *Journal of Financial Economics*, *24*(2), 343-361. https://doi.org/10.1016/0304-405X(89)90051-2

Berger, A., & Udell, G. (1998). The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. *Journal of Banking & Finance*, *22*, 613-673.

https://doi.org/10.1016/S0378-4266(98)00038-7

Bessler, W., & Kurth, A. (2003). *The performance of venture-backed IPOs in Germany: Exit strategies, lock-up periods, and bank ownership*. Center for Finance and Banking, Justus-Liebig-University Giessen.

Bessler, W., & Seim, M. (2012). The performance of venture-backed IPOs in Europe. *Venture Capital*, *14*(4), 215-239. https://doi.org/10.1080/13691066.2012.702447

Bessler, W., & Thies, S. (2008). Initial public offerings, subsequent seasoned equity offerings, and long-run performance: Evidence from IPOs in Germany. *The Journal of Entrepreneurial Finance & Business Ventures*, *11*(3).

Brav, A., & Gompers, P. (1997). "Myth or reality?" The long-run underperformance of initial public offerings: Evidence from venture- and non-venture capital backed companies. *The Journal of Finance*, *52*(5), 1791-1821. https://doi.org/10.1111/j.1540-6261.1997.tb02742.x

Chemmanur, T. J., & Fulghieri, P. (1999). A theory of the going-public decision. *Review of Financial Studies*, *12*(2), 249-279. https://doi.org/10.1093/rfs/12.2.249

Conrad, J., & Gautam, K. (1993). Long-term market overreaction or biases in computed returns? *Journal of Finance, 48*, 39-63. https://doi.org/10.1111/j.1540-6261.1993.tb04701.x

EQT Partners AB. (2017). *EQT*. Retrieved from http://www.eqt.dk/About-EQT/About-Private-Equity/

Federal Ministry of Finance. (2013). *To the point: Financial market regulation*. Public Relations Division.

Greenwood, R., & Nagel, S. (2009). Inexperienced investors and bubbles. *Journal of Financial Economics*, *93*(2), 239-258. https://doi.org/10.1016/j.jfineco.2008.08.004

HVCA. (2016). *Hungarian Private Equity and Venture Capitalist Association*. Retrieved from http://www.hvca.hu/pevc-explained/private-equity/exit-routes-in-private-equity-transactions/

Ibbotson, R. (1975). Price performance of common stock new issues. *Journal of Financial Economics*, *2*(3), 235-272. https://doi.org/10.1016/0304-405X(75)90015-X

Investopedia. (2017). *Investopedia*. Retrieved from http://www.investopedia.com/terms/i/ipo.asp

Johansson, L. (2011). *The performance of private equity-backed IPOs and the effect of M&A-activity—A European study*. Lund University, School of Economics and Management Department of Business and Administration.

Johnson, N. J. (1978). Modified t-tests and confidence intervals for asymmetrical populations. *Journal of the American Statistical Association*, *73*(363). https://doi.org/10.2307/2286597

Kaplan, S. N., & Strömberg, P. (2008). Leveraged Buyouts and Private Equity. *The Journal of Economic Perspectives*, *23*(1), 121-146. https://doi.org/10.1257/jep.23.1.121

Krishnan, C., Ivanov, V. I., Masulis, R. W., & Singh, A. K. (2009). Venture capital reputation, post-IPO performance and corporate governance. *Journal of Financial and Quantitative Analysis (JFQA), Forthcoming*.

Lammi, J. (2016). *The long-run performance of PE and VC backed IPOs-Evidence from the Nordic and*

German markets. Aalto University, School of Business & Department of Finance.

Levis, M. (2008). *The London markets and private equity-backed IPOs*. British Private Equity and Venture Capital Association (BVCA) and London Stock Exchange (LSE) Report.

Levis, M. (2011). The performance of private equity-backed IPOs. *Financial Management, 40*(1), 253-277. https://doi.org/10.1111/j.1755-053X.2010.01141.x

Ljungqvist, A. (2004). *IPO under-pricing*. Handbooks in Finance. Empirical Corporate Finance, Chapter III.4: IPO Under-pricing.

Loughran, T., & Ritter, J. R. (1995). The new issues puzzle. *The Journal of Finance, 50*(1), 23-51. https://doi.org/10.1111/j.1540-6261.1995.tb05166.x

Lucas, D., & McDonald, R. (1990). Equity issues and stock price dynamics. *Journal of Finance, 45*, 1019-1043. https://doi.org/10.1111/j.1540-6261.1990.tb02425.x

Lyon, J. D., Barber, B. M., & Tsai, C. (1999). Improved methods for tests of long-run abnormal stock returns. *The Journal of Finance*, *54*(1), 165-201. https://doi.org/10.1111/0022-1082.00101

Moelis & Company. (2017). *Leveraged buy-out angle of M&A*. M&A Workshop, Moelis & Company.

Nyman, M. (2002). *Riskkapital: Private equity-och venture capital investeringar*. Norstedts Juridik. Stockholm.

Ritter, J. R. (1984). The "hot issue" market of 1980. *Journal of Business, 57*(2), 215-240. https://doi.org/10.1086/296260

Ritter, J. R. (1991). The long-run performance of initial public offerings. *Journal of Finance, 46*, 3-27. https://doi.org/10.1111/j.1540-6261.1991.tb03743.x

Rock, K. (1986). Why new issues are under-priced. *Journal of Financial Economics*, *15*(1), 187-212. https://doi.org/10.1016/0304-405X(86)90054-1

Schultz, P. (2003). Pseudo market timing and the long-run underperformance of IPOs. *Journal of Finance*, *58*(2), 483-517. https://doi.org/10.1111/1540-6261.00535

Stein, J. (2005). Why are most funds open-end? Competition and the limits of arbitrage. *Quarterly Journal of Economics*, *120*(1), 247-272.

Weild, D., & Kim, E. (2010). *Market structure is causing the IPO crisis—And more*. Grant Thornton Capital Market Series.

Welch, I. (1989). Seasoned offerings, imitation costs, and the under-pricing of initial public offerings. *Journal of Finance, 44*, 421-449. https://doi.org/10.1111/j.1540-6261.1989.tb05064.x

Notes

Note 1. Financial sponsoring = financing by private equity and venture capital.

Note 2. Secondary buyouts = company is sold from a financial sponsor to another financial sponsor.

Note 3. IPOs = first time the stock of a private company is traded in the public market.

Note 4. Private equity firms aim to invest up to 15% of a fund into any one investment.

Note 5. IRR = Internal rate of return, which is the discount rate that must be applied to the sponsor's

cash outflows and inflows during the investment horizon in order to produce a net present value (NPV) of zero; Retrieved from http://www.investopedia.com/terms/i/irr.asp

Note 6. Public = companies' shares get listed on the stock market for the first time.

Note 7. Issuing firm = the firm that is going public.

Note 8. Negative abnormal return of -29.1% within the three-year period after the IPO.

Note 9. Sponsor-backed = backed by private equity or venture capital financing.

Note 10. With value weighted returns, the magnitude of underperformance of non-backed IPOs was significantly diminished.

Note 11. Benchmarks = Equity market indexes (e.g., DAX).

Note 12. Total number of IPO raw data (2000-2013) extracted from Zephyr and Thomson Reuters Datastream without the exclusion, etc. = 549 IPOs.

Note 13. https://www.msci.com/documents/10199/d76361cb-d5a5-4185-97ce-ec5e3dd5bf2e

Note 14. FTSE industry classes (10): Oil & Gas, Basic Materials, Industrials, Consumer Goods, Health Care, Consumer Services, Telecommunication, Utilities, Financials, Technology. Retrieved from http://www.ftse.com/products/downloads/icb_rules.pdf

Note 15. EBITDA = Earnings before interest, taxes, depreciation and amortization.

Note 16. Sponsor-backed = Backed by private equity or venture capital.

Note 17. Table 1 Definitions: NB = non-backed; SB = sponsor-backed (PE&VC); PE = private equity-backed; VC = venture capital-backed; FY = financial year.

Note 18. A boom period for instance implies an upward movement of the stock market index.

Note 19. *Significant at 10% (0.1 significance level), **Significant at 5% (0.05 significance level), ***Significant at 1% (0.01 significance level).

Note 20. MSCI Germany Index: 2.153 (date: 01.05.2017).

Note 21. 2013 represents the latest available year for providing data that allows the long-run performance investigation of IPOs for a three year period.

Note 22. Retrieved from http://www.reuters.com/article/us-snap-ipo-idUSKBN1690I7